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ABSTRACT

Learning Network Design (LND) is a socially oriented methodology for construction of cooperative distance learning environments. The paper advances a social constructivist approach to learning in which learning and teaching are seen as a process of active communication, interpretation, and negotiation; offers a view of information technology as a medium of constrained communication; and finally develops an approach to the design of cooperative learning environments. It is argued that the embedded engineering paradigms that accompany telematic media are inappropriate for the design and construction of interactive social environments. An alternative process-oriented paradigm is proposed for the development of a design methodology. This paradigm sees learning as coordinated communication and computer technologies as communication tools. The approach to learning offered takes account of the potential openness in communication offered by the time and/or distant independent technologies of advanced cooperative learning technologies. It offers a socio-cognitive perspective on learning stressing the importance of: context; coordination of action within a contextual framework; the active nature of learning; the role of the tutor; and the role of other learners as a resource. The focus of LND is on the importance of communication in context. It provides the parameters for design "with the user." (Contains 10 references.) (MAS)

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Learning Network Design: A Methodology for the Construction of Co-operative Distance Learning Environments.

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Abstract: Learning Network Design is a socially oriented methodology for construction of co-operative distance learning environments. The paper advances a social constructivist approach to learning in which learning and teaching are seen as a process of active communication, interpretation and negotiation; offers a view of information technology as a medium of constrained communication; and finally develops an approach to the design of co-operative learning environments.

Interaction over distance and/or time, in its modern sense of rapid exchange, implies the use of telematic media. These telematic media arrive with embedded design attitudes towards their utilisation. The paper will argue that the embedded engineering paradigms that accompany these technologies are inappropriate for the design and construction of interactive social environments and will propose an alternative process-oriented paradigm for the development of a design methodology more appropriate to co-operative distance learning environments.

This paradigm has two strands embedded within it seeing:

a. Learning as Co-ordinated Communication

b. Computer Technologies as Communication Tools

and offers a common **communication-oriented basis** from which to view both learning and information technology and from which to develop a theory-based and **systematic approach to design.**

Approaches to Design

The computing and telecommunications industries developed within a traditional engineering paradigm. This paradigm is linear and uni-directional. Products are specified, designed, manufactured and delivered. Once specified a product is deemed to have entered a production cycle and not subject to change. The focus is on the design of products within technical systems where the formal design methodologies assume that change is costly. These methodologies are constructed to ensure that specification is as complete as possible. Many of the comments by those at the receiving end of this approach show their disenchantment with these formal methods where 'systems designers' produce computing systems that have little relationship to the needs of the end users.

This engineering paradigm although applied to computing and information systems is totally inappropriate and unnecessary as the underlying technologies, unlike physically produced objects, are capable of being restructured on an ongoing basis. In the context of interaction over distance to some extent this move is already evident in the telecommunications sector with the development of INS (Intelligent Network Services) and the related concept of VPNs (Virtual Private Networks) which enable end users to construct, deconstruct and reconstruct multiple logical networks that then overlay actual physical telecommunications infrastructures.

An alternative paradigm is process rather than product oriented and advances that computing and information systems are socio-technical systems and, like 'soft' human systems are, capable of restructuring dynamically. The paradigm is therefore iterative and circular. It recognises that there is a specification or analysis phase and that is followed by design and system development, but argues that

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non of these phases are closed or linear. In other words the user can, and should be, involved at all stages in the development cycle. In this world there is never any **end product** simply a stage in an ongoing development process.

This is the background to the need to develop a formalised design methodology for the construction of co-operative learning environments. This paper now:

1. Advances a social constructivist approach to learning in which learning and teaching is seen as a process of active communication, interpretation and negotiation.
2. Develops a view of information technology as a medium of constrained communication
3. Finally offers an approach to the design of co-operative learning environments.

1. Learning as Co-ordinated Communication.

'There is no way, none, in which a human being could possibly master the world without the aid and assistance of others for, in fact, the world is others.' (Bruner in Wertsch 1985.) The reason for starting with this obvious statement is that most learning theories ignore this reality. In the many-to-many interactions enabled by the advanced learning technologies based on telematics this social dimension cannot be ignored. An approach to learning is required that can deal with both the social and individual dimensions of learning.

In overview only this section of the paper :

a. Stresses the process of communication, in particular:
i.) the importance of context; ii) the role of 'rules' as 'co-ordination tools'; iii) the purpose of 'role' in the co-ordination of communication;
b. Links the above analysis to communication-oriented approach to learning using the following Vgotskyian-influenced approach:
i. Learning requires, a) the necessary existing cognitive competence, b) the necessary conceptual 'bridge' between the new and the old,
ii. That this bridging process between new and old conceptual structures is an intrinsically social process whether for 'individuals' or for groups
iii. and that, in general, the 'tutor' is a key factor in enabling this 'bridging' or 'scaffolding' between the 'new' and the 'old' to take place to take place in learning.
iv. We therefore need to identify the elements that underlay the communication processes that enable learning
v. and develop an appropriate (collaborative) pedagogy for both individuals and groups in which learning can take place
c. And finally, to operationalise the approach with an emphasis on: i) the role of the tutor in learning; ii) implications for design and for collaboration

In summary, the approach to learning offered takes account of the potential openness in communication offered by the time and/or distant independent technologies of advanced co-operative learning technologies. It offers a socio-cognitive perspective on learning stressing the importance of:

1. Context
2. Co-ordination of action within a contextual framework
3. The active nature of learning
4. The role of the tutor
5. The role of other learners as a resource

(see Davies, 1992 for detailed exposition of above)

2. Computer Technologies as Communications Technologies

This section develops the theme that computer technologies are communication media and focuses on two linked areas:

i. The nature of **interaction** with computer technology
ii. The nature of **integration** of computer technology

in learning settings.

In particular it advances that:

1. Computer technologies are interactive communication technologies. They are however:

a.. technologies of 'constrained communication' (Petri, 1977), and

b. general purpose non-context specific machines i.e. context-insensitive

2. The co-ordination of action is **medium dependent** and does not automatically transfer to computer-based systems.

From this and in the context of the use of advanced computer technologies for learning collaboratively and otherwise we can immediately identify a list of areas for concern:

a. The effect and role of the media used

b. Nature of the 'constraints' in computer technology

c. Problems of contextualising interaction

d. Co-ordination of interaction in complex learning scenarios via telematic systems.

Petri (1977) sees computers as, *'a general communication medium for strictly organised information flow'* What is the nature of this strictly organised flow? As the surrogate interaction enabled by computers cannot control for external context it must constrain interaction in order to enable dialogue to occur at all. It does this by restricting the nature of allowable dialogue precisely.

The problem with this constraint is that a number of different provider perspectives have to be accommodated to deliver any co-operative learning environment understandable by its users. In particular the important role of metacommunication in learning was outlined earlier. For the co-ordination of action three linked elements were required: a. recognition of context, b. communication rules, c. assumption of role(s). However, computers as general purpose tools for interactive communication do not have a 'context' embedded within them. They are media of constrained communication. They do embody communication rules, but the rules are programmed by their designers. Since the machines themselves are unable to contextualise they require users to **adapt** to their embedded rules. They do this by having the role of 'surrogate partner' embedded within their programming. (Maass 1983). The computers' 'role' as a partner will however be limited to knowledge of the application running and to a generic context. All these points make current computer-based communication system a difficult medium for enabling co-operation.

In summary for a computer-supported co-operative learning environment the following matrix can be developed:

	Co-ordination	**Communication**
Dialogue with Machine	**Machine Controlled**	**Constrained**
Dialogue with People	**Structured by Context and Application**	**Open, but with media constraints to bandwidth**

It now clear computer systems are communication technologies, but with a particular and limited set of interactive capabilities. The role of this section has not been to offer a set of learning methods, but rather to point out that these technologies are in fact communication media. They therefore need to be treated in design terms as any other communication media whilst at the same time recognising their important interactive capabilities and disadvantages. In this sense they are enabling in that they can act as a communication medium for co-ordinating interaction across time and distance. (Davies, 1992 for further details)

3. Learning Network Design

Given the socio-cultural approach to learning with advanced interactive communication technologies advanced here - *Computer-Supported Co-operative Learning* (Davies, 1988) - what does this imply for the design of distance learning environments in the light of the comments above? O 'Malley(1990) sees two main issues for the design of collaborative systems:

1. 'how to construct an environment in which learners can share representations and contribute equally to the joint activity'
2. 'how to design the appropriate representations and tools which will make it possible for learning to take place'
The focus is therefore on the design of collaborative communication media and tools for both its initial construction and end-user manipulation. This section offers a process approach to design and develops a methodology for the production of co-operative learning environments

3.1 Designing With the User

The 'user' in technology-based learning systems is a problematic concept. Is it the learner, the tutor, the author, the course manager, the administrator, ...? In large scale telematics-based environments it is all these users. The point is that each of these 'users' has different perspectives on what is essentially an 'organisation'. This shared 'environment' can be sliced into a number of logical views depending on the viewpoint of the 'user'. It is therefore the role of the service provider and of Learning Network Design to accommodate these views by providing the design tools to enable their conceptualisation and ultimately their construction.
Learning Network Design is a design methodology developed from the 'soft systems' design methodology of Checkland and suitable for the design of 'loosely coupled systems'. Typically, these systems are human organisations: *'By 'methodology' I do not mean method....My sense of the word here is that the outcome of the research is not a method but a set of principles of method which in any particular situation have to be reduced to a method uniquely suitable to that particular situation.' Checkland (1979.)* Learning Network Design methodology, when applied in a particular context, will give rise to a localised design method appropriate to that context. LND therefore, is not simply about the design of the technical components of learning systems it also concerns the total design of the learning environments AND the parameters to action within them.
The parameters to Learning Network Design are:

1. Methodology as Generic:
Problems are often generic, but solutions are generally local. LND therefore, is a methodology rather than a method. It may spawn several actual methods that are 'situated' in the cultural sense (both in the wider national or regional sense and in a local sense in terms of say, an organisation)
2. Focused on Providing Solutions for Learning in Co-operative Situations
To enable the process of learning in groups
3. Scaleable
Can handle a pair (tutor and student) or the organisational complexity of a major training provider with many thousands of students
4. Simple & Structured
Consists of few elements and so able to be employed with course providers

Learning Network Design therefore is concerned with the design of **'virtual learning environments'**. That is, of enabling the creation of the integrated communication and co-ordination structures and tools that will assist the learning process in time and/or distance learning environments. These are:

a. the system/infrastructural architecture ('context and communication structures')
b. tools for action inside the environment ('communication resources')

and project the views in this paper on computer technologies and the nature of learning.

Learning Network Design is a process rather than product approach to design with the following parameters:

'- relevance with respect to setting
-"quality" defined by looking from the user to the program - to assess programs 'relevance' or 'adequacy' with respect to a particular form of work

-people's competence defined in relation to their own professional practice - and their competence to be continually changing as part of a learning process
-'referent system' composed of "human work, learning and communication" - so in process of continual change and modification .' Suchman (1988)

These issues are addressed within the multiple user perspectives enabled by Learning Network Design with the focus being on the design of communication structures to aid teaching and learning processes. In particular, the fostering of the social processes that will enable cognitive development.

3.2 Learning Network Design

The focus of LND is on the importance of communication in context. LND does not specify an exact specification, rather it provides the parameters for design 'with the user'. These parameters point to the importance of communication and the co-ordination of action at the levels of :

- **Context**
- **Group**
- **Individual**

and focused on :

- **communication**
- **co-ordination of action**
- **role.**

This gives the following generic grid for Learning Network Design:

	Context	**Group**	**Individual**
Communication	Immanent	Structured	'Tool' Use within medium
Co-ordination	Via embedded communication structures	Via dynamic structuring	Mental Models
Role	Embedded performatives	Logical Attribute	'Plans for Action'

This above matrix is the generic design framework for CSCL systems. Design methods should evolve in context from this framework. It can now be operationalised in the task oriented context of particular course requirements. For example it has been used as the basis for the construction of the **'Multimedia Teleschool'** (Berlitz, 1993). This gives the following outline results for the design of a distance language course for delivery via CMCS:

	Context	**Group**	**Individual**
Communication	Constructed metaphor - *'Virtual Language School'*	Closed Task-oriented groups	Written world
Co-ordination	CMCS Embedded Structures - 'Seminar Rooms'	Tutor Directed Learning Structures	Interaction in Learning Group
Roles	Tutor Learner Administrator	From Context and Group Maintenance	Dynamic role 'playout'

Further detailed design will emanate from this matrix at the level of sub-context, sub-group and individual.

4.Conclusion

The approach offered in this paper has been to:

1. Offer a social constructivist pedagogy focused on the role of communication and its co-ordination
2. Argue that computer technologies are media of communication.
3. Develop a linked communication-oriented design methodology - Learning Network Design

In summary, Learning Network Design is a structure for design. As with for example, the design of any organisation, the actual design process should be implemented by those who commission (the users) and by those who advise and implement. The actual implementation is an iterative process of proposal, criticism and reproposal. Learning Network Design offers a framework for design for the realisation of advanced co-operative distance learning environments.

References:

Berlitz (1992) 'The Multimedia Teleschool - Functionalities and Pedagogic Scenarios' European Commission DGXIII DELTA Project D2021 Deliverable 3.1. The Multimedia Teleschool. *Berlitz European Projects*, Frankfurt.

Berlitz (1993) The Multimedia Teleschool. *Berlitz European Projects*, Frankfurt.

Bruner J. (1985) Vygotsky: a historical and conceptual perspective. In *Culture, Communication and Cognition: Vygotskian Perspectives. J.W. Wertsch (ed) Cambridge University Press, Cambridge.*

Bruner. J (1986) 'Actual Minds, Possible Worlds' *Harvard University Press*

Checkland P.B. (1979) 'Techniques in 'Soft' Systems Practice Part 1: Systems Diagrams - Some Tentative Guidelines' *J.App.Systems Analysis, 6, 33-49.*

Davies D (1988) ' Computer-supported Co-operative Learning Systems' *PLET 25 (2)*

Maass S. (1983) Why Systems Transparency?. In Green T, Payne S.J, & Van der Veer G.C. (eds) *'The Psychology of Computer Use'* Academic Press, London

O'Malley C & Scanlon E. (1990) 'Computer-support Collaborative Learning: Problem Solving and Distance Education' in Kibby M. 'Computer Assisted Learning' *Proc. CAL'89 Conference.* University of Surrey, UK. 11-14th April, 1989.

Petri C.A. (1977) 'Communications Disciplines' in Shaw B. (ed) 'Computing System *Design' Proc. J. IBM. Seminar* at University of Newcastle-on-Tyne, UK. 7 - 10 Sept. 1976.

Suchman L.(1988) Review of "Computers and Democracy: A Scandinavian Challenge' (1987) by Bjerknes, Ehn P, Kyng M (eds) Gower Press, Brookfield, VT. In *ACM Trans. on Office Info. Sys.* 6 (2), 173-183